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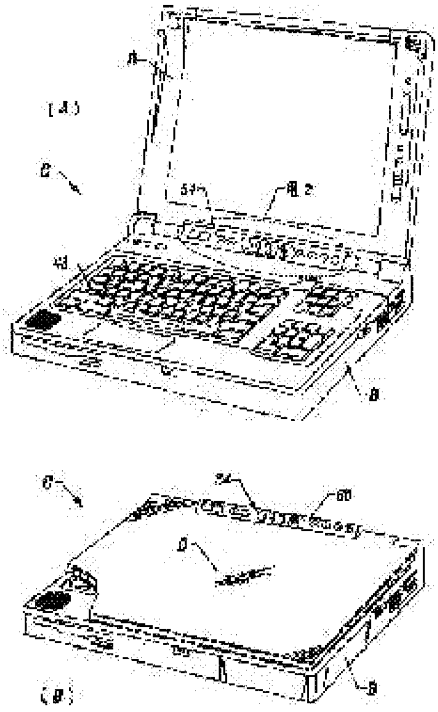
(54) PORTABLE COMPUTER SYSTEM WITH BATTERY CONDITION DISPLAY FUNCTION



(57)Abstract:
PROBLEM TO BE SOLVED: To confirm precisely and quickly the charging residual amount of a battery in a portable computer system.
SOLUTION: Whatever the main display D of the portable computer system C is in open or closed state, a condition display 54 is arranged so that a user can see it. The condition display 54 displays if a system is supplied with power, if a battery is charged with an AC adapter or if the system is in secondary operation mode and is controlled by a microcontroller in the system. Battery charge condition is displayed in steps of 10% in a range of 0% to 100%, and by this a computer operation remaining time by the battery can be estimated. The condition display 54 can display without making an operating system intervene and thus the residual amount of battery charge can quickly

be confirmed.

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CLAIMS

[Claim(s)]

[Claim 1] Have the dc-battery gage display which functions without needing the actuation from a user side, and it sets to the portable computer system which can equip with a battery pack. It is combined with the body part which holds a keyboard and a processor, and said body part. The Maine display part movable between an open position and a closed position, It has the dc-battery gage icon which displays the charge condition of a battery pack. The portable computer system characterized by having the dc-battery condition display prepared in said body part so that it could check by looking, when said Maine display part was in a closed position.

[Claim 2] The portable computer system characterized by having the multiple-purpose microcontroller which generates a dc-battery status-display control signal for said body part to answer information from a battery pack, and control said dc-battery condition display further in a portable computer system according to claim 1.

[Claim 3] The portable computer system characterized by said multiple-purpose microcontroller generating said dc-battery status-display control signal in a portable computer system according to claim 2, without making the Maine operating system of said portable computer system intervene.

[Claim 4] The portable computer system characterized by said dc-battery gage icon being in an icon display condition in a portable computer system according to claim 1 when the battery pack is charged through the AC adapter.

[Claim 5] The portable computer system characterized by said dc-battery gage icon being in an icon display condition in a portable computer system according to claim 1 when said portable computer system has received supply of power from the battery pack.

[Claim 6] The portable computer system characterized by being in an icon display

condition in a portable computer system according to claim 1 when said dc-battery gage icon has said portable computer system in a low power mode of operation.
[Claim 7] The portable computer system characterized by being in an icon display condition in a portable computer system according to claim 1 when said dc-battery gage icon has said portable computer system in a secondary mode of operation.
[Claim 8] The portable computer system characterized by being the mode which reproduces the audio CD with which said secondary mode of operation loaded the CD-ROM drive in a portable computer system according to claim 7, without making an operating system intervene.
[Claim 9] The portable computer system characterized by having the indicator with which said dc-battery condition display displays actuation of said portable computer system in said secondary mode of operation further in a portable computer system according to claim 7.
[Claim 10] The portable computer system characterized by being the gradual rate display said whose dc-battery gage icon expresses gradually the rate of a charge residue to the maximum charge of a battery pack in a portable computer system according to claim 1.
[Claim 11] The portable computer system characterized by having the dc-battery icon which indicates equipped with the battery pack in a portable computer system according to claim 1 because said dc-battery condition display will be in an icon display condition further.
[Claim 12] The portable computer system characterized by having the AC adapter icon which indicates that the AC adapter is connected to said portable computer system in a portable computer system according to claim 1 because said dc-battery condition display will be in an icon display condition further.
[Claim 13] The portable computer system by which said dc-battery condition scope is characterized by being arranged more nearly up than said keyboard in a portable computer system according to claim 1.
[Claim 14] The portable computer system by which said dc-battery condition scope is characterized by consisting of liquid crystal displays in a portable computer system according to claim 1.
[Claim 15] Have the dc-battery gage display which functions without needing the actuation from a user side, and it sets to the portable computer system which can equip with a battery pack. It is combined with the body part which holds a keyboard and a processor, and said body part. The Maine display part movable between an open position and a closed position, It has the dc-battery gage icon which displays the charge condition of a battery pack. The portable computer system characterized by having the dc-battery condition display prepared in said body part so that it could check by looking, even if said Maine display part was in any of a closed position and an open position.
[Claim 16] The portable computer system characterized by having the multiple-purpose microcontroller which answers the information which receives a dc-battery status-display control signal for said body part to control said dc-battery condition display further from a battery pack in a portable computer system according to claim 15, and is generated.
[Claim 17] The portable computer system characterized by said multiple-purpose microcontroller generating said dc-battery status-display control signal in a portable computer system according to claim 16, without making the Maine operating system of said portable computer system intervene.

[Claim 18] The portable computer system characterized by being in an icon display condition in a portable computer system according to claim 15 when said dc-battery gage icon has said portable computer system in a secondary mode of operation.
[Claim 19] It is combined with a battery pack, a body part, and said body part. The Maine display part movable between an open position and a closed position, In the approach of displaying dc-battery charge information by the portable computer system which has the microcontroller combined with said battery pack The step which takes out charge status information from said battery pack through said microcontroller, The step which generates a dc-battery status-display control signal based on said charge status information taken out from said battery pack, To the dc-battery condition display prepared in said body part so that it could check by looking, when said Maine display part was in a closed position, by telling said dc-battery status-display control signal The approach characterized by including the step which displays battery pack charge status information by the method showing the rate of the charge residue of said battery pack.
[Claim 20] The approach characterized by the ability to check by looking in an approach according to claim 19 also when said Maine display part has said dc-battery condition display in an open position further.
[Claim 21] The approach characterized by performing said step in an approach according to claim 19 when said portable computer system is in a secondary mode of operation.
[Claim 22] The approach characterized by performing said step in an approach according to claim 19 when said portable computer system is in a low power mode of operation.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the dc-battery gage display of real time which functions in more detail, without making an operating system intervene about the circuit and approach for displaying the dc-battery charge condition of a portable computer system.
[0002]
[Description of the Prior Art] It will often be necessary to use a computer in the mobile environment which cannot use the usual AC power supply. Generally in such a situation, it is used, the dc-battery, i.e., the battery, which can be charged instead of. [AC power supply] A variety of dc-batteries which have sufficient engine performance already exist, it is newly developed one after another, for example, batteries, such as a lithium polymer battery, are used for a nickel-cadmium (NiCd) cell, a nickel-metal-hydrogen (NiMH) cell, a lithium ion (Li+) cell, and it. If these batteries are used, power can be supplied to a portable computer system for several hours. Constituting a battery pack combining two or more batteries is also performed, and, generally these batteries are connected to the serial in that case. In many cases, it is whether charge of a battery pack is performed by external charging equipment, or carried out using the power source of host computer system.
[0003] Thus, although use in a mobile environment is attained by using a charge-type dc-battery, there is a limitation in the time amount which can be used by one charge. Therefore, there are some which gave the function of a nest and a residue meter about the

sensor circuit which carries out the monitor of the electrical potential difference of each battery in the battery pack to a battery pack. The function of a residue meter is a process which judges the usable charge residue of each battery or its battery pack, and this judgment is performed by usually measuring an electrical-potential-difference pair current. Moreover, as for a sensor circuit, the existence of a too little electrical potential difference, overvoltage, the excessive charging current, and the excessive discharge current is checked by generally carrying out the monitor of the battery, and the charge and discharge of a battery pack are made to be performed by it appropriately.
[0004] Moreover, there are some which are called the "intelligent battery pack" and this supplies dc-battery information to the microcontroller for dc-battery control from the sensor circuit built in the battery pack. A microcontroller judges whether the battery pack needs charge, it can discharge based on the supplied information, or the use limitation was arrived at. This judgment result is transmitted to host computer system. Further, the charge and discharge of a battery pack are performed according to the condition of the battery in a battery pack, or this kind of battery pack is prevented, when it has the charge switch and the discharge switch and a microcontroller controls these switches.
[0005]
[Problem(s) to be Solved by the Invention] Many of current portable computers changed the data about the charge condition supplied from the microcontroller for dc-battery control, and he is trying to display it on the Maine video display of the computer, and it has realized such a function according to the software process. Generally, in order to perform such a software process, a user needs to perform actuation for it. Although the actuation for performing software for dc-battery gages (dc-battery meter) can be simplified by using a functional allotment key and an icon, other problems accompany the approach of displaying a dc-battery charge residue on a display, in addition to the ease of actuation. With the problem, in order to perform the software process, I hear that it must wait to supply a power source to a portable computer and to complete initialization of an operating system, and it is about it. Since the initialization process of an operating system takes most time amount, for the user who confirmed the charge condition of a battery pack and who can hold, this latency time is too long.
[0006] Although there is a thing equipped with the light emitting diode (LED) or liquid crystal display (LCD) which offers the information on a dc-battery charge condition in a portable computer system, such a system cannot say that it has sufficient practicality, either. That is, it only displays only by having one LED only about whether it is in the condition which can supply power for a battery pack to operate the computer system. Therefore, in order to presume the operating time which will be left behind by the time charge of a dc-battery is needed also in this case, a user has to refer to the dc-battery gage by software. Therefore, the functionality and use ease of having excelled more are searched for about the method for getting to know a dc-battery charge residue, and this invention is offering the portable computer system which can solve the trouble of such a conventional example.
[0007]
[Means for Solving the Problem] The portable computer system concerning this invention is equipped with the dc-battery gage display of self-supporting real time which can be checked by looking also when a closing condition has the Maine video display. When the power source of a system is switched on and the dc-battery is charged by this

dc-battery gage display with the AC adapter, a user can do the monitor of the charge condition of a battery pack to it on it, also when a portable computer is in a secondary mode of operation. This dc-battery gage display functions without making the operating system of a portable computer system intervene, and a user can check a dc-battery residue, without starting a software process.

[0008] The dc-battery gage display concerning the gestalt of the operation indicated here is constituted by some multiple-purpose LCD condition display modules connected to the mother board of a system. The control signal for controlling a LCD condition display is generated by the multiple-purpose microcontroller. This microcontroller has received dc-battery status information from the monitor circuit, and can control a LCD condition display, without making the operating system of computer system intervene. Since a dc-battery charge condition is displayed by unit 10% in 0% - 100% of range, a user can presume correctly the remaining computer operating time maintainable [with the battery pack with which it is then equipped]. Since this dc-battery gage display is what can function without making the operating system of a portable computer system intervene, a user can check a dc-battery charge residue, without starting a software process. Especially this invention is useful when the portable computer system is being used by non-standard modes of operation, such as CD player mode.

[0009]

[Embodiment of the Invention] Although it explains and goes to a detail with reference to a drawing about the concrete example of this invention from this, the United States patent application which has the contents relevant to this invention is first hung up as bibliography before that. The United States patent application 08th / No. 846641 which were transferred to the applicant of this application (the name of invention:) [COMPUTER SYSTEM CAPABLE OF PLAYINGAUDIO CDS IN A CD-ROM DRIVE] INDEPENDENT OF AN OPERATING SYSTEM (computer system which enabled it to reproduce the audio CD with which the CD-ROM drive was loaded, without making an operating system intervene), Artificer: Tim L. Zang, Greg B. Memo and Kevin R. Frost, filing-date-of-application:April 30, 1997. United States patent ****** transferred to the applicant of this application Number (the name of invention: it is the same as the filing date of application of the U.S. application used as the foundation of CONTROLS AND INDICATORS FOR A SECONDARYOPERATIONAL MODE OF A COMPUTER SYSTEM (the controller and indicator for controlling and displaying the secondary mode of operation of computer system), artificer:Bill Jacobs, Luke Mondshine and Dan Forlenza, and filing-date-of-application:this application).

[0010] (A) of drawing 1 and (B) are the perspective views of the portable computer system C equipped with the dc-battery gage display concerning this invention. Computer system C has the body part B and the display part D. The body part B is equipped with the keyboard 48 and the condition display 54 for displaying the condition of the dc-battery concerning this invention. The condition display 54 is a legible part on the body part B, and also when the display part D is in any of an open position (A of drawing 1), and a closed position (B of drawing 1), it is prepared in the part 80 which the user of computer system C can see. Therefore, a user can check, without opening the display D which is the Maine display about the charge condition of the battery pack with which it is equipped. Although arbitration is easy to be suitable for the class of display D, the display of the class which operates with low power is desirable, for example, can use a

liquid crystal display (LCD) and a thin film transistor (TFT).
[0011] Drawing 2 is the enlarged drawing of the dc-battery gage display concerning the example of this invention. Like illustration, the condition display 54 is equipped with two or more icons 90, and these icons 90 are for telling the information on a dc-battery charge condition and others. The switch 92 of two or more bezel carbon button formats and one electric power switch 58 other than the condition display 54 are prepared in the part 80 in which the above-mentioned check by looking of the body part B is possible. The switch 92 of bezel carbon button ****** plays the role of the control switch which controls that actuation, when this portable computer system C is in a secondary mode of operation. Two or more icons 90 are one of the descriptions of this invention, and contain dc-battery gage icon (dc-battery residue meter icon) 90a. This icon 90a can display a dc-battery charge condition by unit 10% in 0% - 100% of range, and a user can presume correctly the remaining computer operating time maintainable [with the battery pack with which it is then equipped by this icon 90a]. Moreover, this dc-battery gage icon 90a enables it to check a dc-battery charge condition, without supplying a power source to computer system and starting software routines (for example, the "Windows 95 dc-battery meter" etc.). The following dc-battery icon 90b is the icon which will be in an icon display condition, when the portable computer system C is equipped with the battery pack. Similarly, AC adapter icon 90c is the icon which will be in an icon display condition, when computer system has received supply of power from the AC adapter.
[0012] The condition display 54 is equipped with icon 90d for indicating that computer system is in a secondary mode of operation further. In the example of this invention currently indicated here, the secondary mode of operation of computer system C is a mode of operation on which this computer system C functions as a CD player of a standalone version, and this is later explained further to a detail. Furthermore, as for the switch 92 of a bezel carbon button format, it is desirable to offer the function which the control carbon button of a common audio CD player offers, and the same function, for example, it consists of this example so that functions of **, such as playback/halt, a halt, a front truck, degree truck, and sound-volume control, may be offered. the condition display 54 -- the above icon -- in addition, it is desirable to have had other icons (un-illustrating) further, for example, it can be equipped with the icon showing the present condition of the function of the figure keylock of a keyboard 48, a capital letter lock, and Scroll Lock by being in an icon display condition.
[0013] In the example of this invention, when it is made to be in an icon display condition when it is in various predetermined situations, for example, computer system has received supply of power from the AC adapter which is an interruptible power source and supply of power is received from the battery pack, each of two or more icons 90 is in situations when computer system is operating by the secondary mode of operation during charge of a battery pack, when computer system is in sleeping, i.e., a high-burr nation condition. moreover, when the dc-battery charge residue displayed by dc-battery gage icon 90a falls even to 10%, computer system C generates a beep sound -- both, it constitutes so that dc-battery icon 90b may be blinked. Furthermore, it constitutes so that it may control to go into high-burr nation mode automatically, after computer system C generates a beep sound twice, if it judged that the dc-battery charge residue fell even to 5% and the AC adapter moreover was not then connected by the multiple-purpose microcontroller. If it goes into high-burr nation mode, in order for computer system C to

be in "OFF" condition and to make computer system C restart, it is necessary for a user to do the depression of the electric power switch 58.
[0014] As a condition display 54, the display which operates by the low battery of the class of others other than LCD may be used. The strict explanation about what kind of property the class of display to be used needs to have is not important when clarifying this invention. Furthermore, this invention is applicable suitable also for the portable computer system which can equip with two or more battery packs. When applying to such a system, you may make it display in order the charge condition of all the battery packs with which added the icon 90, and you may make it equipped with the icon which functions as a charge residue meter of the battery pack for each battery pack of every, or enabled scrolling of the icon of drawing 2 of, and it has equipped one after another.
[0015] Drawing 3 is the circuit diagram of the computer system C of the suitable example of this invention. The illustrated computer system C is equipped with the two main buses (primary bus). One of them is PCI busP and this PCI bus P contains a part for the address/data division, and the control signal part. Another is ISA BusI and this ISA Bus I contains a part for a part for address part, and data division, and the control signal part. The fundamental skeleton of the architecture of computer system C consists of such PCI bus P and ISA Bus I. CPU / memory subsystem 94 is connected to PCI busP. CPU10 and the 2nd level (L2) cache 12 are mutually connected through the processor bus. CPU10 -- IBM-PC -- it is desirable that it is what operates with compatible standard operating systems (for example, Windows 95 etc.). The cache function which L2 cache 12 offers reinforces the function of the on-chip cache of CPU10, and raises the totality ability of computer system C.
[0016] These CPUs10 and L2 cache 12 are connected to the host / PCI bridge 14. The synchronization (SDRAM) DRAM 16 is further connected to the host / PCI bridge 14. The host / PCI bridge 14 has achieved the function which combines CPU / memory subsystem 94 with PCI bus P. The PCMCIA/CardBus controller 18 is combined with PCI busP and this controller 18 has achieved the function to connect two or more PCMCIA cards 22. The peripheral device of various classes for extending the function of the portable computer system C is recorded by these PCMCIA cards 22. The video controller circuit 20 is also further connected to PCI busP. Video memory and an analog circuit required in order to control the video display 21 are included in this video controller circuit 20.
[0017] PCI bus P and ISA Bus I are connected by the PCI/ISA bridge 24. PCI / ISA bridge 24 performs signal transformation between PCI bus P and ISA Bus I. An address buffer, a data buffer, the Arbitration circuit for PCI bus P (mediation circuit) and bus master control logic, the ISA mediation circuit, the ISA Bus controller usually used for the ISA system, the IDE (intelligent drive electronics) interface, and the DMA controller are contained on this PCI/ISA bridge 24. The hard disk drive 30 and CD-ROM drive 28 are connected to the IDE interface of the PCI/ISA bridge 24. In addition to these, the peripheral device (un-illustrating) of others, such as a tape drive, is connectable similarly. An IDE interface is a kind of IDE / ATA interface, and is an interface which could achieve the function as a bus master and incorporated the strengthening IDE function. As for CD-ROM drive 28, it is desirable to be based on ATAPI (AT attachment packet interface) which is an IDE standard for a CD-ROM drive.
[0018] The PCI/ISA bridge 24 contains two or more PIC (PICs)15 which consists of two

or more programmable interrupt controllers (PIC) for managing a hardware interrupt according to the priority. As for PIC15, it is desirable to consider as the thing of the structure which carried out cascade connection of the two PIC so that 16 kinds of interrupts IRQ0-IRQ15 can be enabled. In the example currently indicated here, the PCI/ISA bridge 24 is further equipped with multi-function-system logic. This multi-function-system logic contains the interrupt controller corresponding to both PCI busP and ISA Bus I, and power management logic while containing various counters and the activity timer with which the common personal computer system is usually equipped. Furthermore, you may make it include the circuit which constitutes the security management system which achieves the function in which this multi-function-system logic performs password verification, and permits access to a protection resource. Although constituting in the form of a single integrated circuit is desirable as for the PCI/ISA bridge 24, it can also be constituted in other forms.

[0019] Many of other devices have combined with ISA BusI further. A modem 32 and the audio chip 34 are in the inside of these devices. The audio chip 34 is further combined with the device 36 for outputting an analog signal. This device 36 is 1 set of loudspeakers with which for example, the computer system C was equipped, an external stereo system, etc. When this device 36 is a loudspeaker, even if the display part D of computer system C is in a closed state, it is desirable to consider as the configuration it can be heard that voice is. The combination I/O (S-IO) chip 38 is further combined with ISA BusI. Various address decoding logic, security logic, etc. for controlling access to the password value stored in the access list to CMOS / NVRAM memory (un-illustrating) constituted as the floppy disk controller, the internal memory, or external memory for various functional elements being built into the S-IO chip 38, for example, controlling a real-time clock, two or more UART, and a floppy disk drive 44 there are incorporated. The S-IO chip 38 is further equipped with the parallel port 40 and the serial port 42. Although various devices and systems with which common computer system is usually equipped besides what was explained above were built into this portable computer system C, these devices and a system were omitted by drawing 3 from a viewpoint of making clear the characteristic component and the operation effectiveness of this invention.

[0020] The keyboard controller 46 is further combined with ISA BusI. The keyboard controller 46 has achieved the function to connect a keyboard 48, the PS/2 port 50, and an electric power switch (PS) 58 to a system. The keyboard controller 46 generates data signal LCD_DATA and clock signal LCD_CLK further, and these signals are signals used in the LCD control circuit 55. The LCD control circuit 55 generates the control signal for controlling the LCD condition display 54. In addition, although the keyboard controller is taking charge of the above function, it replaces with a keyboard controller and you may make it make a microcontroller take charge of the above function in the example currently indicated here. The details configuration of the LCD control circuit concerning this invention is later explained to a detail with reference to drawing 4 .

[0021] The keyboard controller 46 of this invention includes the system management interrupt circuit (SMI circuit) for generating a system management interrupt (SMI) further. The inside of a processor is equipped with the mode called a System Management Mode (SMM) like for example, the Pentium processor, and if SMI is received, there is a thing it was made to go into this System Management Mode. SMI is a non masker bull interrupt and the priority of the **** highest is given to it among various

interrupts in a system. If SMI occurs, an SMI manipulation routine will be started. The SMI manipulation routine is stored in the protected memory address space so that it cannot usually access, only when CPU10 is in a System Management Mode. An SMI manipulation routine is a kind of interrupt service routine essentially created for the purpose of performing a specific system management task, and a specific system management task here is a task of making the specified device into low power mode, for example, or performing security service. It is easy for this contractor to create the code of an SMI manipulation routine so that various tasks may be performed.

[0022] In the example of this invention currently indicated here, it is constituted so that computer system C can function as a CD player of a standalone version. The mode of operation which functions as a CD player is one example of a "secondary mode of operation", and in order to support this mode of operation, the keyboard controller 46 is further combined with the audio CD mode switch (DM_SW) 56. When the electric power switch 58 of computer system C is in "ON" condition, this audio CD mode switch 56 is made into the invalid state. On the other hand, when the electric power switch 58 of computer system C is in "OFF" condition, it changes this audio CD mode switch 56 into the effective condition. When this audio CD mode switch 56 is in an effective condition, computer system C is made into audio CD mode according to the condition of this switch 56. That is, the computer system C concerning this invention will become audio CD mode, if it changes the audio CD mode switch 56 into "ON" condition. If it becomes audio CD mode, the computer system C concerning this invention bypasses BIOS which is the system currently generally used, and can reproduce the audio CD with which CD-ROM drive 28 is loaded, without making an operating system intervene.

[0023] In the computer system C of the example of this invention, after going into audio CD mode, power is supplied to CPU / memory subsystem 94, the PCI/ISA bridge 24, CD-ROM drive 28, the host/PCI bridge 14, audio CD-ROM60, and the keyboard controller 46. Furthermore it continues, and when CD control carbon button chooses and is operated, in order to perform processing according to it, the code stored in ROM is loaded. In this example, since it has stored in the CD-ROM device 60 which prepared that code separately [the usual BIOS ROM device 62], loading in this case is performed from the CD-ROM device 60. Moreover, at this time, since loading of an operating system is not performed, initialization of a system is completed for a short time. In addition, you may make it store both in a single ROM device instead of forming the ROM device which stores the general BIOS code as mentioned above, and the ROM device which stores the audio CD code according to an individual.

[0024] In a secondary mode of operation, when computer system C goes into audio CD mode, the audio CD selection signal DMSEL is sent out and a multiplexer 64 is supplied. PCI / ISA bridge 24 of this multiplexer 64 is good also as a configuration which you may make it combine with PCI / ISA bridge 24 what was constituted separately, or was built in PCI / ISA bridge 24. When the audio CD selection signal DMSEL is not sent out, the multiplexer 64 has chosen usual BIOS-ROM62, therefore is outputting BIOS control signal BIOS_CS. On the other hand, when the audio CD selection signal DMSEL is sent out, the multiplexer 64 has chosen audio CD-ROM60 concerning this invention, therefore is outputting audio CD control signal DM_CS. If audio CD-ROM60 is chosen, it is desirable to make it the video controller 20, a hard disk drive 30, a floppy disk drive 44, and the PCMCIA/CardBus controller 18 set in the condition that power is not supplied, in

code sent out from this audio CD-ROM60, and it can reduce system-wide power consumption by it. Furthermore, when it is in audio CD mode, it is desirable that it is made to change S-IO38 into a low power condition. The further detail about the portable computer system which enabled it to function as a CD player of a standalone version currently indicated as a concrete example here is explained into the specification of the United States patent application mentioned to the beginning of explanation of this example as bibliography. In addition, the detailed explanation about the method which includes the secondary mode of operation which is option mode in the portable computer system C is not especially important when explaining this invention.

[0025] The part of the battery pack BP in drawing 3 is further explained to a detail. A battery pack BP is inserted in the portable computer system C in drawing 3 . Computer system C can also receive supply of power from a battery pack BP, and it is constituted so that power can also be conversely supplied to a battery pack BP. The electrical potential difference of terminal VBATT+ is equal to the electrical potential difference of the positive terminal of a battery pack BP, and the electrical potential difference of terminal VBATT- is equal to the electrical potential difference of the negative terminal of a battery pack BP. Transmission and reception of power are performed between a battery pack BP and computer system C through these two terminals. In addition, although the configuration only equipped with one battery pack BP was shown in computer system C at drawing 3 , this invention is applicable also to the configuration which equips one set of the portable computer system C with two or more removable battery packs.

[0026] The battery pack BP is equipped with the microcontroller 100 for dc-battery control, and this microcontroller 100 offers the function manager which controls charge-and-discharge actuation of a battery (group) 102. The microcontroller 100 for dc-battery control is a programmable controller programmable according to arrangement of the class of battery to be used, and two or more batteries, or how to combine. The microcontroller 100 for dc-battery control supplies various signals to the control logic block 104. The control logic block 104 generates various control signals for controlling various components of a switching circuit 106 based on these signals. These control logic block 104 and a switching circuit 106 collaborated, and the control function which prevents / permits the inflow of the charging current to a battery 102 and the outflow of the discharge current from a battery 102 is achieved. The signal which controls charge actuation of a battery 102, the signal which controls ****** actuation, and the signal which controls discharge actuation to it are included in two or more signals which the control logic block 104 generates.

[0027] The switching circuit 106 is connected to the positive terminal "+" of a battery 102. As illustrated, the battery 102 of a battery pack BP connects to 4 sets and a serial what connected the battery of a simple substance to juxtaposition at two trains, and was made into one group, and consists of suitable examples. Moreover, it is constituted so that electrical-potential-difference VBATT+ impressed from a battery 102 (to or battery group 102) and the current which carries out outflow close to a battery pack BP may be controlled by various transistors in a switching circuit 106. The monitor circuit 108 is further shown in drawing 3 , and this monitor circuit 108 is connected to the "+" terminal of the battery group 102, and the "-" terminal. The monitor circuit 108 supplies the information about the condition of a battery 102 during activation of charge and discharge to the microcontroller 100 for dc-battery control. In the inside of various

functions of the monitor circuit 108, the monitor of the overvoltage of a battery, the monitor of the too little electrical potential difference of a battery, the monitor of the excessive discharge current, and the monitor of the charging current excessive to it are. Being able to make the circuitry of the monitor circuit 108 various, they are the things of common knowledge to this contractor.

[0028] The keyboard controller 46 communicates between the microcontrollers 100 for dc-battery control through the standard bus between integrated circuits (I2 C bus). I2 C bus is a bidirectional 2 line bus of an easy configuration of having been developed in order to perform control between integrated circuits efficiently. The detail about I2 C bus is Phillips. It is indicated by "The I2 C-bus and How toUse It (Including Specification)" which Semiconductor published. If the outline is described, I2 C bus consists of two lines. One of them is a serial clock (SCL) line, one more is a serial-data (solvent deasphalting) line, and each of these is congruence directional traverses. A SCL line supplies the clock signal for the data transfer performed through I2 C bus. A solvent deasphalting line is the data line for the data transfer performed through I2 C bus. The electrical potential difference or touch-down electrical potential difference of VBATT- serves as criteria of the logical level of these signals. It is recognized whether the device connected to I2 C bus is the microcontroller 100 for dc-battery control of the battery pack BP which the each is recognized by the address of a proper, namely, is then equipped with whether the device is the keyboard controller 46 also with it. The information which communicates between the keyboard controller 46 and the microcontroller 100 for dc-battery control has for example, a charge demand, a charge termination demand, etc. other than above-mentioned charge status information.

[0029] AC adapter 120 for supplying power is further shown in the portable computer system C at drawing 3 . This AC adapter 120 usually considers the alternating current of 90V-120V as an input with effective voltage. The commercial power in the U.S. is an alternating current whose nominal voltage is 120V. If the output voltage of AC adapter 120 is not what suited the maximum charge electrical potential difference of a battery pack BP, and suited the input voltage specification of the power source of the portable computer system C, it will not become. In the suitable example, power is 52W and is the common power unit constituted as an inverter to the direct current from the alternating current of a single output, and as an information machine dexterous power unit, worldwide, AC adapter 120 is designed so that it may be usable. AC adapter 120 is equipment which functions independently, obtains power from the main power supply line (un-illustrating) of an alternating current (AC), and outputs the power of a direct-current (DC) constant voltage as a single output. Although it does not have the electric power switch as illustrated, this is because it is made to have generated output power when AC input is supplied from the electric code 126. AC adapter 120 may be built in a system, and may be constituted as a device with outside.

[0030] Drawing 4 is the block diagram of the LCD control circuit 55 for controlling two or more display icons 90 of the LCD condition display 54 concerning this invention. The LCD control circuit 55 is combined between the keyboard controller 46 and the LCD condition display 54. Like previous statement, it is combined with the battery pack BP and the keyboard controller 46 has received the information about the charge condition of a battery 102. The keyboard controller 46 changes into a display condition the display segment to which the LCD condition display 54 corresponds according to this

information. Furthermore, if it explains in detail, the keyboard controller 46 sends out a LCD DATA signal to the data input of the shift register 200 of a serial input / parallel output method. The keyboard controller 46 has sent out the CLOCK signal further, and this CLOCK signal is supplied to each clocked into of a shift register 200 and a shift register 202. Moreover, one of two or more outputs of a shift register 200 is supplied to the data input of a shift register 202. And various segment status signals are generated based on the output of others of a shift register 200, and two or more outputs of a shift register 202, and these segment status signal is a signal which changes each segment of two or more display icons 90 of the LCD condition display 54 into a display condition. If actuation is explained, according to the CLOCK signal from the keyboard controller 46, it will act as clock Inn of the data to shift registers 200 and 202, and the data will be changed into parallel data by this. If the above configuration is adopted, the number of the pin assigned in order to operate the LCD condition display 54 among the pins of the keyboard controller 46 can be substituted for two.

[0031] As for two or more outputs of shift registers 200 and 202, each of these outputs is supplied to one input of the one gate in two or more exclusive OR gates 204. The 60Hz clock signal is supplied to the input of another side of each exclusive OR gate. Therefore, the output of each exclusive OR gate 204 is refreshed per second 60 times. Moreover, the output of each exclusive OR gate is connected to the control line for controlling each segment of two or more display icons 90 of the LCD condition display 54 through the LCD connector 206. The output of the LCD connector 206 is modulated by the signal which reversed the 60Hz above-mentioned clock signal through the inverter 208. This modulation is for preventing damage on the component of the LCD condition display 54.

[0032]

[Effect of the Invention] As explained above, according to the portable computer system concerning this invention, a user can check easily correctly the charge residue of the battery pack with which it is then equipped, even if any of an open position and a closed position have the Maine display. This dc-battery gage display is controlled to be in a display condition, when this computer system is equipped with the dc-battery gage display of self-supporting real time, the power source is supplied to the portable computer system, the dc-battery is charged with the AC adapter, and a portable computer system is in a secondary mode of operation at it. This dc-battery gage display functions without making the operating system of a portable computer system intervene, and a user can check a dc-battery residue, without starting a software process. An indication and explanation of the above this invention can add various modification also to the details configuration and the method of operation of the circuit concretely shown also as opposed to connection of the dimension, a configuration, the quality of the material, a component part, a circuit element, and wiring and the gestalt of a contact for the purpose of showing the example of this invention to the last, and structure, without deviating from the concept of this invention.

TECHNICAL FIELD

[Field of the Invention] This invention relates to the dc-battery gage display of real time which functions in more detail, without making an operating system intervene about the

circuit and approach for displaying the dc-battery charge condition of a portable computer system.

PRIOR ART

[Description of the Prior Art] It will often be necessary to use a computer in the mobile environment which cannot use the usual AC power supply. Generally in such a situation, it is used, the dc-battery, i.e., the battery, which can be charged instead of. [AC power supply] A variety of dc-batteries which have sufficient engine performance already exist, it is newly developed one after another, for example, batteries, such as a lithium polymer battery, are used for a nickel-cadmium (NiCd) cell, a nickel-metal-hydrogen (NiMH) cell, a lithium ion (Li+) cell, and it. If these batteries are used, power can be supplied to a portable computer system for several hours. Constituting a battery pack combining two or more batteries is also performed, and, generally these batteries are connected to the serial in that case. In many cases, it is whether charge of a battery pack is performed by external charging equipment, or carried out using the power source of host computer system.

[0003] Thus, although use in a mobile environment is attained by using a charge-type dc-battery, there is a limitation in the time amount which can be used by one charge. Therefore, there are some which gave the function of a nest and a residue meter about the sensor circuit which carries out the monitor of the electrical potential difference of each battery in the battery pack to a battery pack. The function of a residue meter is a process which judges the usable charge residue of each battery or its battery pack, and this judgment is performed by usually measuring an electrical-potential-difference pair current. Moreover, as for a sensor circuit, the existence of a too little electrical potential difference, overvoltage, the excessive charging current, and the excessive discharge current is checked by generally carrying out the monitor of the battery, and the charge and discharge of a battery pack are made to be performed by it appropriately.

[0004] Moreover, there are some which are called the "intelligent battery pack" and this supplies dc-battery information to the microcontroller for dc-battery control from the sensor circuit built in the battery pack. A microcontroller judges whether the battery pack needs charge, it can discharge based on the supplied information, or the use limitation was arrived at. This judgment result is transmitted to host computer system. Further, the charge and discharge of a battery pack are performed according to the condition of the battery in a battery pack, or this kind of battery pack is prevented, when it has the charge switch and the discharge switch and a microcontroller controls these switches.

EFFECT OF THE INVENTION

[Effect of the Invention] As explained above, according to the portable computer system concerning this invention, a user can check easily correctly the charge residue of the battery pack with which it is then equipped, even if any of an open position and a closed position have the Maine display. This dc-battery gage display is controlled to be in a display condition, when this computer system is equipped with the dc-battery gage display of self-supporting real time, the power source is supplied to the portable computer system, the dc-battery is charged with the AC adapter, and a portable computer system is

in a secondary mode of operation at it. This dc-battery gage display functions without making the operating system of a portable computer system intervene, and a user can check a dc-battery residue, without starting a software process. An indication and explanation of the above this invention can add various modification also to the details configuration and the method of operation of the circuit concretely shown also as opposed to connection of the dimension, a configuration, the quality of the material, a component part, a circuit element, and wiring and the gestalt of a contact for the purpose of showing the example of this invention to the last, and structure, without deviating from the concept of this invention.

TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] Many of current portable computers changed the data about the charge condition supplied from the microcontroller for dc-battery control, and he is trying to display it on the Maine video display of the computer, and it has realized such a function according to the software process. Generally, in order to perform such a software process, a user needs to perform actuation for it. Although the actuation for performing software for dc-battery gages (dc-battery meter) can be simplified by using a functional allotment key and an icon, other problems accompany the approach of displaying a dc-battery charge residue on a display, in addition to the ease of actuation. With the problem, in order to perform the software process, I hear that it must wait to supply a power source to a portable computer and to complete initialization of an operating system, and it is about it. Since the initialization process of an operating system takes most time amount, for the user who confirmed the charge condition of a battery pack and who can hold, this latency time is too long.
[0006] Although there is a thing equipped with the light emitting diode (LED) or liquid crystal display (LCD) which offers the information on a dc-battery charge condition in a portable computer system, such a system cannot say that it has sufficient practicality, either. That is, it only displays only by having one LED only about whether it is in the condition which can supply power for a battery pack to operate the computer system. Therefore, in order to presume the operating time which will be left behind by the time charge of a dc-battery is needed also in this case, a user has to refer to the dc-battery gage by software. Therefore, the functionality and use ease of having excelled more are searched for about the method for getting to know a dc-battery charge residue, and this invention is offering the portable computer system which can solve the trouble of such a conventional example.

MEANS

[Means for Solving the Problem] The portable computer system concerning this invention is equipped with the dc-battery gage display of self-supporting real time which can be checked by looking also when a closing condition has the Maine video display. When the power source of a system is switched on and the dc-battery is charged by this dc-battery gage display with the AC adapter, a user can do the monitor of the charge condition of a battery pack to it on it, also when a portable computer is in a secondary mode of operation. This dc-battery gage display functions without making the operating

system of a portable computer system intervene, and a user can check a dc-battery residue, without starting a software process.
[0008] The dc-battery gage display concerning the gestalt of the operation indicated here is constituted by some multiple-purpose LCD condition display modules connected to the mother board of a system. The control signal for controlling a LCD condition display is generated by the multiple-purpose microcontroller. This microcontroller has received dc-battery status information from the monitor circuit, and can control a LCD condition display, without making the operating system of computer system intervene. Since a dc-battery charge condition is displayed by unit 10% in 0% - 100% of range, a user can presume correctly the remaining computer operating time maintainable [with the battery pack with which it is then equipped]. Since this dc-battery gage display is what can function without making the operating system of a portable computer system intervene, a user can check a dc-battery charge residue, without starting a software process. Especially this invention is useful when the portable computer system is being used by non-standard modes of operation, such as CD player mode.
[0009]
[Embodiment of the Invention] Although it explains and goes to a detail with reference to a drawing about the concrete example of this invention from this, the United States patent application which has the contents relevant to this invention is first hung up as bibliography before that. The United States patent application 08th / No. 846641 which were transferred to the applicant of this application (the name of invention:) [COMPUTER SYSTEM CAPABLE OF PLAYINGAUDIO CDS IN A CD-ROM DRIVE] INDEPENDENT OF AN OPERATING SYSTEM (computer system which enabled it to reproduce the audio CD with which the CD-ROM drive was loaded, without making an operating system intervene), Artificer: Tim L. Zang, Greg B. Memo and Kevin R. Frost, filing-date-of-application:April 30, 1997. United States patent ****** transferred to the applicant of this application Number (the name of invention: it is the same as the filing date of application of the U.S. application used as the foundation of CONTROLS AND INDICATORS FOR A SECONDARYOPERATIONAL MODE OF A COMPUTER SYSTEM (the controller and indicator for controlling and displaying the secondary mode of operation of computer system), artificer:Bill Jacobs, Luke Mondshine and Dan Forlenza, and filing-date-of-application:this application).
[0010] (A) of drawing 1 and (B) are the perspective views of the portable computer system C equipped with the dc-battery gage display concerning this invention. Computer system C has the body part B and the display part D. The body part B is equipped with the keyboard 48 and the condition display 54 for displaying the condition of the dc-battery concerning this invention. The condition display 54 is a legible part on the body part B, and also when the display part D is in any of an open position (A of drawing 1), and a closed position (B of drawing 1), it is prepared in the part 80 which the user of computer system C can see. Therefore, a user can check, without opening the display D which is the Maine display about the charge condition of the battery pack with which it is equipped. Although arbitration is easy to be suitable for the class of display D, the display of the class which operates with low power is desirable, for example, can use a liquid crystal display (LCD) and a thin film transistor (TFT).
[0011] Drawing 2 is the enlarged drawing of the dc-battery gage display concerning the example of this invention. Like illustration, the condition display 54 is equipped with two

or more icons 90, and these icons 90 are for telling the information on a dc-battery charge condition and others. The switch 92 of two or more bezel carbon button formats and one electric power switch 58 other than the condition display 54 are prepared in the part 80 in which the above-mentioned check by looking of the body part B is possible. The switch 92 of bezel carbon button ****** plays the role of the control switch which controls that actuation, when this portable computer system C is in a secondary mode of operation. Two or more icons 90 are one of the descriptions of this invention, and contain dc-battery gage icon (dc-battery residue meter icon) 90a. This icon 90a can display a dc-battery charge condition by unit 10% in 0% - 100% of range, and a user can presume correctly the remaining computer operating time maintainable [with the battery pack with which it is then equipped by this icon 90a]. Moreover, this dc-battery gage icon 90a enables it to check a dc-battery charge condition, without supplying a power source to computer system and starting software routines (for example, the "Windows 95 dc-battery meter" etc.). The following dc-battery icon 90b is the icon which will be in an icon display condition, when the portable computer system C is equipped with the battery pack. Similarly, AC adapter icon 90c is the icon which will be in an icon display condition, when computer system has received supply of power from the AC adapter.

[0012] The condition display 54 is equipped with icon 90d for indicating that computer system is in a secondary mode of operation further. In the example of this invention currently indicated here, the secondary mode of operation of computer system C is a mode of operation on which this computer system C functions as a CD player of a standalone version, and this is later explained further to a detail. Furthermore, as for the switch 92 of a bezel carbon button format, it is desirable to offer the function which the control carbon button of a common audio CD player offers, and the same function, for example, it consists of this example so that functions of **, such as playback/halt, a halt, a front truck, degree truck, and sound-volume control, may be offered. the condition display 54 -- the above icon -- in addition, it is desirable to have had other icons (un-illustrating) further, for example, it can be equipped with the icon showing the present condition of the function of the figure keylock of a keyboard 48, a capital letter lock, and Scroll Lock by being in an icon display condition.

[0013] In the example of this invention, when it is made to be in an icon display condition when it is in various predetermined situations, for example, computer system has received supply of power from the AC adapter which is an interruptible power source and supply of power is received from the battery pack, each of two or more icons 90 is in situations when computer system is operating by the secondary mode of operation during charge of a battery pack, when computer system is in sleeping, i.e., a high-burr nation condition. moreover, when the dc-battery charge residue displayed by dc-battery gage icon 90a falls even to 10%, computer system C generates a beep sound -- both, it constitutes so that dc-battery icon 90b may be blinked. Furthermore, it constitutes so that it may control to go into high-burr nation mode automatically, after computer system C generates a beep sound twice, if it judged that the dc-battery charge residue fell even to 5% and the AC adapter moreover was not then connected by the multiple-purpose microcontroller. If it goes into high-burr nation mode, in order for computer system C to be in "OFF" condition and to make computer system C restart, it is necessary for a user to do the depression of the electric power switch 58.

[0014] As a condition display 54, the display which operates by the low battery of the

class of others other than LCD may be used. The strict explanation about what kind of property the class of display to be used needs to have is not important when clarifying this invention. Furthermore, this invention is applicable suitable also for the portable computer system which can equip with two or more battery packs. When applying to such a system, you may make it display in order the charge condition of all the battery packs with which added the icon 90, and you may make it equipped with the icon which functions as a charge residue meter of the battery pack for each battery pack of every, or enabled scrolling of the icon of drawing 2 of, and it has equipped one after another.
[0015] Drawing 3 is the circuit diagram of the computer system C of the suitable example of this invention. The illustrated computer system C is equipped with the two main buses (primary bus). One of them is PCI busP and this PCI bus P contains a part for the address/data division, and the control signal part. Another is ISA BusI and this ISA Bus I contains a part for a part for address part, and data division, and the control signal part. The fundamental skeleton of the architecture of computer system C consists of such PCI bus P and ISA Bus I. CPU / memory subsystem 94 is connected to PCI busP. CPU10 and the 2nd level (L2) cache 12 are mutually connected through the processor bus. CPU10 -- IBM-PC -- it is desirable that it is what operates with compatible standard operating systems (for example, Windows 95 etc.). The cache function which L2 cache 12 offers reinforces the function of the on-chip cache of CPU10, and raises the totality ability of computer system C.
[0016] These CPUs10 and L2 cache 12 are connected to the host / PCI bridge 14. The synchronization (SDRAM) DRAM 16 is further connected to the host / PCI bridge 14. The host / PCI bridge 14 has achieved the function which combines CPU / memory subsystem 94 with PCI bus P. The PCMCIA/CardBus controller 18 is combined with PCI busP and this controller 18 has achieved the function to connect two or more PCMCIA cards 22. The peripheral device of various classes for extending the function of the portable computer system C is recorded by these PCMCIA cards 22. The video controller circuit 20 is also further connected to PCI busP. Video memory and an analog circuit required in order to control the video display 21 are included in this video controller circuit 20.
[0017] PCI bus P and ISA Bus I are connected by the PCI/ISA bridge 24. PCI / ISA bridge 24 performs signal transformation between PCI bus P and ISA Bus I. An address buffer, a data buffer, the Arbitration circuit for PCI bus P (mediation circuit) and bus master control logic, the ISA mediation circuit, the ISA Bus controller usually used for the ISA system, the IDE (intelligent drive electronics) interface, and the DMA controller are contained on this PCI/ISA bridge 24. The hard disk drive 30 and CD-ROM drive 28 are connected to the IDE interface of the PCI/ISA bridge 24. In addition to these, the peripheral device (un-illustrating) of others, such as a tape drive, is connectable similarly. An IDE interface is a kind of IDE / ATA interface, and is an interface which could achieve the function as a bus master and incorporated the strengthening IDE function. As for CD-ROM drive 28, it is desirable to be based on ATAPI (AT attachment packet interface) which is an IDE standard for a CD-ROM drive.
[0018] The PCI/ISA bridge 24 contains two or more PIC (PICs)15 which consists of two or more programmable interrupt controllers (PIC) for managing a hardware interrupt according to the priority. As for PIC15, it is desirable to consider as the thing of the structure which carried out cascade connection of the two PIC so that 16 kinds of

interrupts IRQ0-IRQ15 can be enabled. In the example currently indicated here, the PCI/ISA bridge 24 is further equipped with multi-function-system logic. This multi-function-system logic contains the interrupt controller corresponding to both PCI busP and ISA Bus I, and power management logic while containing various counters and the activity timer with which the common personal computer system is usually equipped. Furthermore, you may make it include the circuit which constitutes the security management system which achieves the function in which this multi-function-system logic performs password verification, and permits access to a protection resource. Although constituting in the form of a single integrated circuit is desirable as for the PCI/ISA bridge 24, it can also be constituted in other forms.

[0019] Many of other devices have combined with ISA BusI further. A modem 32 and the audio chip 34 are in the inside of these devices. The audio chip 34 is further combined with the device 36 for outputting an analog signal. This device 36 is 1 set of loudspeakers with which for example, the computer system C was equipped, an external stereo system, etc. When this device 36 is a loudspeaker, even if the display part D of computer system C is in a closed state, it is desirable to consider as the configuration it can be heard that voice is. The combination I/O (S-IO) chip 38 is further combined with ISA BusI. Various address decoding logic, security logic, etc. for controlling access to the password value stored in the access list to CMOS / NVRAM memory (un-illustrating) constituted as the floppy disk controller, the internal memory, or external memory for various functional elements being built into the S-IO chip 38, for example, controlling a real-time clock, two or more UART, and a floppy disk drive 44 there are incorporated. The S-IO chip 38 is further equipped with the parallel port 40 and the serial port 42. Although various devices and systems with which common computer system is usually equipped besides what was explained above were built into this portable computer system C, these devices and a system were omitted by drawing 3 from a viewpoint of making clear the characteristic component and the operation effectiveness of this invention.

[0020] The keyboard controller 46 is further combined with ISA BusI. The keyboard controller 46 has achieved the function to connect a keyboard 48, the PS/2 port 50, and an electric power switch (PS) 58 to a system. The keyboard controller 46 generates data signal LCD_DATA and clock signal LCD_CLK further, and these signals are signals used in the LCD control circuit 55. The LCD control circuit 55 generates the control signal for controlling the LCD condition display 54. In addition, although the keyboard controller is taking charge of the above function, it replaces with a keyboard controller and you may make it make a microcontroller take charge of the above function in the example currently indicated here. The details configuration of the LCD control circuit concerning this invention is later explained to a detail with reference to drawing 4 .

[0021] The keyboard controller 46 of this invention includes the system management interrupt circuit (SMI circuit) for generating a system management interrupt (SMI) further. The inside of a processor is equipped with the mode called a System Management Mode (SMM) like for example, the Pentium processor, and if SMI is received, there is a thing it was made to go into this System Management Mode. SMI is a non masker bull interrupt and the priority of the **** highest is given to it among various interrupts in a system. If SMI occurs, an SMI manipulation routine will be started. The SMI manipulation routine is stored in the protected memory address space so that it cannot usually access, only when CPU10 is in a System Management Mode. An SMI

manipulation routine is a kind of interrupt service routine essentially created for the purpose of performing a specific system management task, and a specific system management task here is a task of making the specified device into low power mode, for example, or performing security service. It is easy for this contractor to create the code of an SMI manipulation routine so that various tasks may be performed.
[0022] In the example of this invention currently indicated here, it is constituted so that computer system C can function as a CD player of a standalone version. The mode of operation which functions as a CD player is one example of a "secondary mode of operation", and in order to support this mode of operation, the keyboard controller 46 is further combined with the audio CD mode switch (DM_SW) 56. When the electric power switch 58 of computer system C is in "ON" condition, this audio CD mode switch 56 is made into the invalid state. On the other hand, when the electric power switch 58 of computer system C is in "OFF" condition, it changes this audio CD mode switch 56 into the effective condition. When this audio CD mode switch 56 is in an effective condition, computer system C is made into audio CD mode according to the condition of this switch 56. That is, the computer system C concerning this invention will become audio CD mode, if it changes the audio CD mode switch 56 into "ON" condition. If it becomes audio CD mode, the computer system C concerning this invention bypasses BIOS which is the system currently generally used, and can reproduce the audio CD with which CD-ROM drive 28 is loaded, without making an operating system intervene.
[0023] In the computer system C of the example of this invention, after going into audio CD mode, power is supplied to CPU / memory subsystem 94, the PCI/ISA bridge 24, CD-ROM drive 28, the host/PCI bridge 14, audio CD-ROM60, and the keyboard controller 46. Furthermore it continues, and when CD control carbon button chooses and is operated, in order to perform processing according to it, the code stored in ROM is loaded. In this example, since it has stored in the CD-ROM device 60 which prepared that code separately [the usual BIOS ROM device 62], loading in this case is performed from the CD-ROM device 60. Moreover, at this time, since loading of an operating system is not performed, initialization of a system is completed for a short time. In addition, you may make it store both in a single ROM device instead of forming the ROM device which stores the general BIOS code as mentioned above, and the ROM device which stores the audio CD code according to an individual.
[0024] In a secondary mode of operation, when computer system C goes into audio CD mode, the audio CD selection signal DMSEL is sent out and a multiplexer 64 is supplied. PCI / ISA bridge 24 of this multiplexer 64 is good also as a configuration which you may make it combine with PCI / ISA bridge 24 what was constituted separately, or was built in PCI / ISA bridge 24. When the audio CD selection signal DMSEL is not sent out, the multiplexer 64 has chosen usual BIOS-ROM62, therefore is outputting BIOS control signal BIOS_CS. On the other hand, when the audio CD selection signal DMSEL is sent out, the multiplexer 64 has chosen audio CD-ROM60 concerning this invention, therefore is outputting audio CD control signal DM_CS. If audio CD-ROM60 is chosen, it is desirable to make it the video controller 20, a hard disk drive 30, a floppy disk drive 44, and the PCMCIA/CardBus controller 18 set in the condition that power is not supplied, in code sent out from this audio CD-ROM60, and it can reduce system-wide power consumption by it. Furthermore, when it is in audio CD mode, it is desirable that it is made to change S-IO38 into a low power condition. The further detail about the portable

computer system which enabled it to function as a CD player of a standalone version currently indicated as a concrete example here is explained into the specification of the United States patent application mentioned to the beginning of explanation of this example as bibliography. In addition, the detailed explanation about the method which includes the secondary mode of operation which is option mode in the portable computer system C is not especially important when explaining this invention.

[0025] The part of the battery pack BP in drawing 3 is further explained to a detail. A battery pack BP is inserted in the portable computer system C in drawing 3 . Computer system C can also receive supply of power from a battery pack BP, and it is constituted so that power can also be conversely supplied to a battery pack BP. The electrical potential difference of terminal VBATT+ is equal to the electrical potential difference of the positive terminal of a battery pack BP, and the electrical potential difference of terminal VBATT- is equal to the electrical potential difference of the negative terminal of a battery pack BP. Transmission and reception of power are performed between a battery pack BP and computer system C through these two terminals. In addition, although the configuration only equipped with one battery pack BP was shown in computer system C at drawing 3 , this invention is applicable also to the configuration which equips one set of the portable computer system C with two or more removable battery packs.

[0026] The battery pack BP is equipped with the microcontroller 100 for dc-battery control, and this microcontroller 100 offers the function manager which controls charge-and-discharge actuation of a battery (group) 102. The microcontroller 100 for dc-battery control is a programmable controller programmable according to arrangement of the class of battery to be used, and two or more batteries, or how to combine. The microcontroller 100 for dc-battery control supplies various signals to the control logic block 104. The control logic block 104 generates various control signals for controlling various components of a switching circuit 106 based on these signals. These control logic block 104 and a switching circuit 106 collaborated, and the control function which prevents / permits the inflow of the charging current to a battery 102 and the outflow of the discharge current from a battery 102 is achieved. The signal which controls charge actuation of a battery 102, the signal which controls ****** actuation, and the signal which controls discharge actuation to it are included in two or more signals which the control logic block 104 generates.

[0027] The switching circuit 106 is connected to the positive terminal "+" of a battery 102. As illustrated, the battery 102 of a battery pack BP connects to 4 sets and a serial what connected the battery of a simple substance to juxtaposition at two trains, and was made into one group, and consists of suitable examples. Moreover, it is constituted so that electrical-potential-difference VBATT+ impressed from a battery 102 (to or battery group 102) and the current which carries out outflow close to a battery pack BP may be controlled by various transistors in a switching circuit 106. The monitor circuit 108 is further shown in drawing 3 , and this monitor circuit 108 is connected to the "+" terminal of the battery group 102, and the "-" terminal. The monitor circuit 108 supplies the information about the condition of a battery 102 during activation of charge and discharge to the microcontroller 100 for dc-battery control. In the inside of various functions of the monitor circuit 108, the monitor of the overvoltage of a battery, the monitor of the too little electrical potential difference of a battery, the monitor of the excessive discharge current, and the monitor of the charging current excessive to it are.

Being able to make the circuitry of the monitor circuit 108 various, they are the things of common knowledge to this contractor.
[0028] The keyboard controller 46 communicates between the microcontrollers 100 for dc-battery control through the standard bus between integrated circuits (I2 C bus). I2 C bus is a bidirectional 2 line bus of an easy configuration of having been developed in order to perform control between integrated circuits efficiently. The detail about I2 C bus is Phillips. It is indicated by "The I2 C-bus and How toUse It (Including Specification)" which Semiconductor published. If the outline is described, I2 C bus consists of two lines. One of them is a serial clock (SCL) line, one more is a serial-data (solvent deasphalting) line, and each of these is congruence directional traverses. A SCL line supplies the clock signal for the data transfer performed through I2 C bus. A solvent deasphalting line is the data line for the data transfer performed through I2 C bus. The electrical potential difference or touch-down electrical potential difference of VBATT- serves as criteria of the logical level of these signals. It is recognized whether the device connected to I2 C bus is the microcontroller 100 for dc-battery control of the battery pack BP which the each is recognized by the address of a proper, namely, is then equipped with whether the device is the keyboard controller 46 also with it. The information which communicates between the keyboard controller 46 and the microcontroller 100 for dc-battery control has for example, a charge demand, a charge termination demand, etc. other than above-mentioned charge status information.
[0029] AC adapter 120 for supplying power is further shown in the portable computer system C at drawing 3 . This AC adapter 120 usually considers the alternating current of 90V-120V as an input with effective voltage. The commercial power in the U.S. is an alternating current whose nominal voltage is 120V. If the output voltage of AC adapter 120 is not what suited the maximum charge electrical potential difference of a battery pack BP, and suited the input voltage specification of the power source of the portable computer system C, it will not become. In the suitable example, power is 52W and is the common power unit constituted as an inverter to the direct current from the alternating current of a single output, and as an information machine dexterous power unit, worldwide, AC adapter 120 is designed so that it may be usable. AC adapter 120 is equipment which functions independently, obtains power from the main power supply line (un-illustrating) of an alternating current (AC), and outputs the power of a direct-current (DC) constant voltage as a single output. Although it does not have the electric power switch as illustrated, this is because it is made to have generated output power when AC input is supplied from the electric code 126. AC adapter 120 may be built in a system, and may be constituted as a device with outside.
[0030] Drawing 4 is the block diagram of the LCD control circuit 55 for controlling two or more display icons 90 of the LCD condition display 54 concerning this invention. The LCD control circuit 55 is combined between the keyboard controller 46 and the LCD condition display 54. Like previous statement, it is combined with the battery pack BP and the keyboard controller 46 has received the information about the charge condition of a battery 102. The keyboard controller 46 changes into a display condition the display segment to which the LCD condition display 54 corresponds according to this information. Furthermore, if it explains in detail, the keyboard controller 46 sends out a LCD DATA signal to the data input of the shift register 200 of a serial input / parallel output method. The keyboard controller 46 has sent out the CLOCK signal further, and

this CLOCK signal is supplied to each clocked into of a shift register 200 and a shift register 202. Moreover, one of two or more outputs of a shift register 200 is supplied to the data input of a shift register 202. And various segment status signals are generated based on the output of others of a shift register 200, and two or more outputs of a shift register 202, and these segment status signal is a signal which changes each segment of two or more display icons 90 of the LCD condition display 54 into a display condition. If actuation is explained, according to the CLOCK signal from the keyboard controller 46, it will act as clock Inn of the data to shift registers 200 and 202, and the data will be changed into parallel data by this. If the above configuration is adopted, the number of the pin assigned in order to operate the LCD condition display 54 among the pins of the keyboard controller 46 can be substituted for two.

[0031] As for two or more outputs of shift registers 200 and 202, each of these outputs is supplied to one input of the one gate in two or more exclusive OR gates 204. The 60Hz clock signal is supplied to the input of another side of each exclusive OR gate. Therefore, the output of each exclusive OR gate 204 is refreshed per second 60 times. Moreover, the output of each exclusive OR gate is connected to the control line for controlling each segment of two or more display icons 90 of the LCD condition display 54 through the LCD connector 206. The output of the LCD connector 206 is modulated by the signal which reversed the 60Hz above-mentioned clock signal through the inverter 208. This modulation is for preventing damage on the component of the LCD condition display 54.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] (A) And (B) is the perspective view of the portable computer system equipped with the dc-battery gage display of one example of this invention.

[Drawing 2] It is the enlarged drawing of the dc-battery gage display in drawing 1 .

[Drawing 3] It is the functional block diagram of a portable computer system which offers the dc-battery gage display function of this invention.

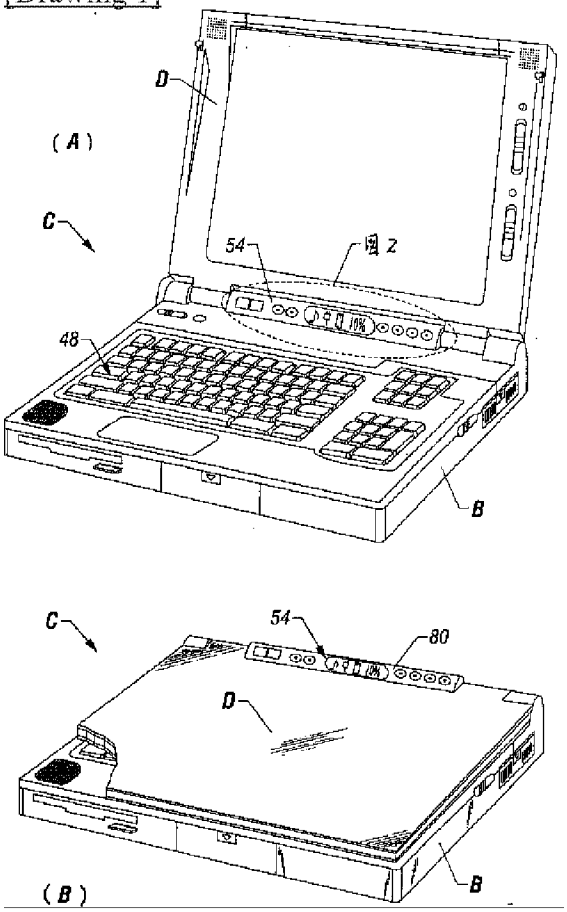
[Drawing 4] It is the functional block diagram of the display control circuit for controlling the dc-battery gage display of this invention.

[Description of Notations]

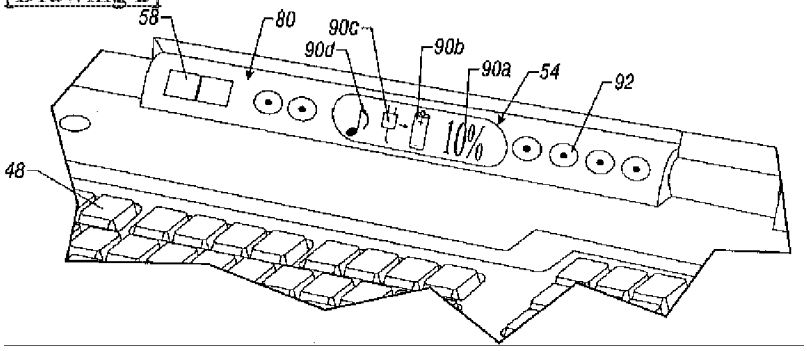
B Body part
C Portable computer system
D Display part
48 Keyboard
54 Condition Display
80 Part Which Can Check Body Part by Looking
90 (90a-90d) Icon
100 Microcontroller

DRAWINGS

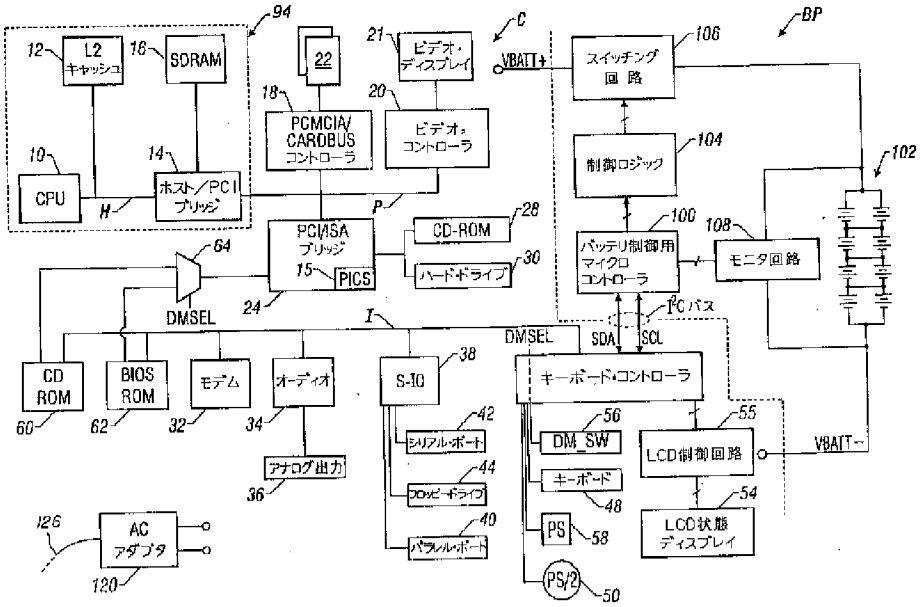
[Drawing 1]



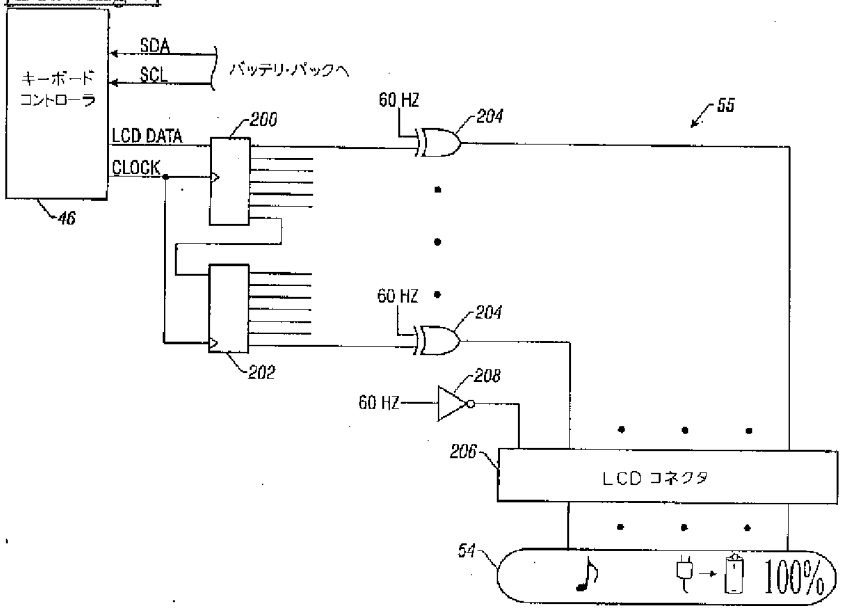
[Drawing 2]



[Drawing 3]


94
12
L2 キャッシュ
16
SDRAM
22
21
ビデオ・ディスプレイ
C
VBATT+
スイッチング回路
106
BP
18
PCMCIA/CARDBUS コントローラ
20
ビデオ・コントローラ
制御ロジック
104
102
10
CPU
14
ホスト/PCI ブリッジ
H
P
PCI/ISA ブリッジ
15
PICS
CD-ROM
28
ハードドライブ
30
バッテリ制御用マイクロコントローラ
100
108
モニタ回路
64
DMSEL
24
I
I²C バス
SDA
SCL
CD ROM
60
BIOS ROM
62
モデム
32
オーディオ
34
アナログ出力
36
S-IO
38
キーボード・コントローラ
シリアル・ポート
42
フロッピードライブ
44
パラレル・ポート
40
56
DM_SW
キーボード
48
PS
58
PS/2
50
LCD制御回路
55
VBAT−
54
LCD状態ディスプレイ
126
AC アダプタ
120

[Drawing 4]


キーボードコントローラ
SDA
SCL
バッテリ・パックへ
LCD DATA
CLOCK
46
200
60 HZ
204
55
202
208
206
LCD コネクタ
54
100%